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VARIATIONS OF THE SURFACE OF MARS.

In the second volume (1888) of the *Bulletin de la Société Astronomique de France*, M. FLAMMARION has two long and studied articles on the *markings* of the planet *Mars*. He is careful to present a great number of *fac-simile* drawings of the planet, which date from 1659 to 1888, so that the evidence which he has used is before the eyes of the reader. After showing that drawings of *Mars* may differ greatly from each other on account of differences of eyes, methods, interpretation, instruments, atmospheric influences both on *Mars* and the earth, and on variations of the inclination of the planet's axis, he goes on to show that there still remain variations which are (probably) not due to any of these causes, and which therefore are to be attributed to real variations in the surface of the planet itself.

Most of the paper is devoted to an examination of the evidence of the drawings. (In this connection it is well to refer to a set of articles by Professor SCHIAPARELLI, in *Himmel und Erde* for October, November and December, 1888, where the same questions are treated also in a masterly manner.) At the close of this examination M. FLAMMARION feels authorized to draw the following conclusions as established facts—leaving all speculation to one side:

I. "There are permanent markings on the surface of *Mars*, which in all probability represent (*doivent représenter*) seas, lakes, regions of water of various kinds, etc. (It has long been known that on this planet there are polar snows which melt in summer, clouds, and the vapor of water shown by spectroscopic observations.)

II. "These markings are permanent; they are seen to-day in the same regions where they were observed in the seventeenth and eighteenth centuries. They are not atmospheric products, then, such as are shown, for example, on *Jupiter*.

III. "However, while they are permanent they are not invariable. They change both in extent and in depth of tone, in different years and without doubt during different seasons [seasons of *Mars*].

IV. "There are some regions which are specially variable. These appear to hold a middle place between continents and seas, and to be marshy lands, which are in turn elevated above and submerged below a thin layer of water.

V. "The continents of *Mars* appear to be flat; and subject to inundations in nearly all their extent.

VI. "The northern hemisphere is more elevated than the southern; the seas are chiefly in the southern hemisphere, and they do not appear to be deep.

VII. "The evaporation on *Mars* is, without doubt, rapid and considerable. Millions of cubic yards of water pass readily from the state of vapor to the state of liquid, and millions of acres pass from the continental to the maritime aspect.

VIII. "Water is perhaps not the only agent concerned in these changes. The general order of things is very different on *Mars* and on the earth."

This is not the place to examine the conclusions critically. In a general way, they all depend upon the assumption that the darker markings on *Mars* represent bodies of water. As this is quite probable (though by no means proved as yet) the eight theorems given above may serve as points of departure in the further working out of this plausible hypothesis. E. S. H.

STABILITY OF THE GREAT EQUATORIAL.

Observations for the position of the great telescope have been made by Messrs. SCHAEBERLE and KEELER, as below :

1888, July 27,	azimuth = + 36";	level = 8" too low.
1889, May 18,	" = — " = 36"	" "
Sept. 16,	" = + 83" " = 58"	" "

There appears to be a slight progressive change in level and probably in azimuth.

MOUNTAIN OBSERVATORIES.

Telescopes "cannot be formed so as to take away that confusion of rays which arises from the tremors of the atmosphere. The only remedy is a most serene and quiet air, such as may perhaps be found on the tops of the highest mountains above the grosser clouds."—Sir ISAAC NEWTON, in his *Opticks*, A.D. 1730.

RAINFALL ON MOUNT HAMILTON.

Meteorological observations have been kept at Mount Hamilton since 1880. The following table of rainfall on the summit is the best available summary. This rainfall is considerably more than that in the Santa Clara Valley near San José (about 13.4 inches) and it is probably considerably less than the fall in some of the cañons and valleys immediately surrounding the mountain. The great variations in the annual amount of rainfall are interesting from a meteorological

point of view, and decidedly inconvenient from a practical one, especially as our reservoir capacity is not quite adequate. E. S. H.

Rainfall at Mount Hamilton in the Years 1880-89.

MONTH.	1880-81	1881-82	1882-83	1883-84	1884-85	1885-86	1886-87	1887-88	1888-89
	in.	in.	in.	in.	in.	in.	in.	in.	in.
July	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
August	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.02
September . .	0.00	0.10	0.00	0.65	0.65	0.15	0.00	0.33	0.49
October	0.00	0.33	6.16	2.15	3.71	0.05	0.60	0.09	0.03
November*	0.50	0.91	3.45	1.48	0.01	—	2.82	0.90	3.27
December . . .	9.68	9.72	1.93	2.05	33.84	—	2.34	11.25	4.23
January	3.51	3.55	3.10	5.60	1.99	—	2.83	10.04	1.04
February . . .	5.99	2.90	3.75	12.76	0.57	1.80	7.80	1.38	1.42
March	1.13	5.40	8.66	16.35	1.15	5.77	1.39	3.40	6.17
April	0.98	4.70	2.66	11.96	2.08	6.79	5.75	0.68	1.92
May	0.09	0.48	7.55	1.24	0.16	0.70	0.25	1.25	3.21
June	0.33	1.06	0.00	3.85	0.36	0.00	0.30	0.67	0.00
Sums	22.21	29.15	37.26	58.09	44.67	—	24.08	30.03	21.80

* November, 1880—One shower, amount assumed to be 0th.50. N. B. December, 1884.

Mean annual rainfall (8 years), *July to July* = 33.41 in.

GREAT TELESCOPE FOR LOS ANGELES.

Authentic information regarding the proposed forty-inch refractor for Wilson's Peak is difficult to obtain. A newspaper report of an interview with Mr. A. G. CLARK on September 28, recites that one of the discs (now on exhibition at Paris) will probably arrive in Boston in October. The other disc is not yet cast, and M. MANTOIS is, apparently, not willing to undertake the work without a contract, which is not yet executed. The Trustees of the Fund have, so it is said, authorized Mr. CLARK to pay \$10,000 for two satisfactory forty-inch discs, which is not an unreasonable price by any means. Mr. CLARK offered to make the objective and the mounting for \$100,000, during his visit to California in the winter of 1888-9. So far as is now known, the fund available for the telescope does not yet exceed \$150,000. Probably \$300,000 to \$400,000 would build and equip the observatory.

E. S. H.